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Topographic analysis of debris flow gullies affected by tectonic activities on the edge of Qinghai-Tibet Plateau

Xinyue Liang¹, Yonggang Ge², Mengzhen Xu³, and Liqun Lyu⁴

¹Key Laboratory of Mountain Hazards and Earth Surface Process, Institute of Mountain Hazards and Environment, CAS; University of Chinese Academy Sciences, China (liangxinyue17@mailsucas.edu.cn)

²Key Laboratory of Mountain Hazards and Earth Surface Process, Institute of Mountain Hazards and Environment, CAS (gyg@imde.ac.cn)

³State Key Laboratory of Hydrosience and Engineering, Tsinghua University (mzxu@mail.tsinghua.edu.cn)

⁴School of Soil and Water Conservation, Beijing Forestry University (lvliqunqinghua@126.com)

The collision between the Indian and the Eurasian Plates make crustal deformation and develop many faults of the Qinghai-Tibet Plateau. Debris flows affected by tectonic activities occur frequently and are various types on the edge of plateau. It is essential to scientifically categorize the debris flow gullies on active fault to understand their mechanisms, prevent and mitigate debris flow disasters. The tectonic landforms are the foundation for debris flows occurrence. Topographical measurements and statistical analyses of seven basins on the edge of the Qinghai-Tibet Plateau were carried out (Yarlung Zangbo River, Nu River, Indus River, Gaizi River, Bailong River, Xiaojiang River and Daheba River), in which typical debris flow gullies were concentrated. The results showed that debris flows were mainly distributed in the most active tectonic uplift zone of seven basins. The debris flow gullies were classified into three types by means of nonmetric multidimensional scaling. Type I was formed by rainstorms in exposed bedrock areas, Type II was formed by glaciers in exposed bedrock areas, and Type III was formed by rainstorms in depositional basins. Based on entropy method and fuzzy mathematics, the susceptibility of debris flow on seven watersheds was analyzed. Type I had good sediment connectivity due to rainstorms and main-river incision, and was easy to form small and middle-scale debris flow. Type II was easy to form high-frequency, middle and large-scale debris flows caused by abundant moraine deposit and good sediment transport under the glacier erosion. Type III was prone to form high-frequency and small-scale debris flows triggered by rainfall and loose depositional materials.